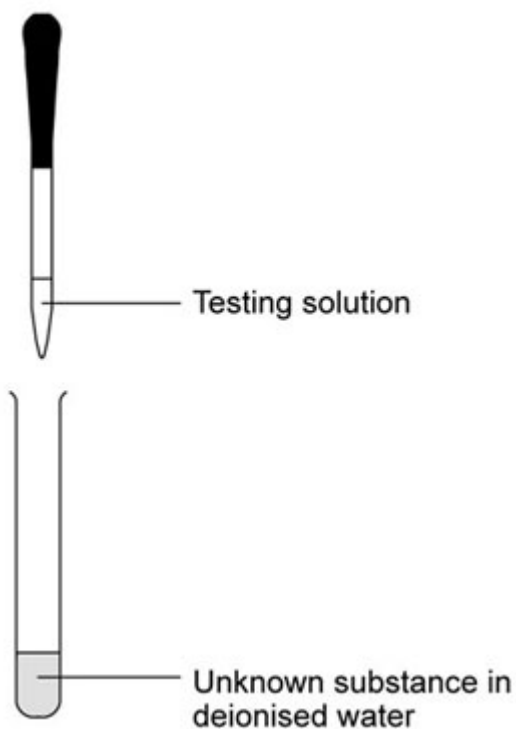


# Student worksheet: Testing salts for anions and cations

## Introduction

Chemists often have to identify the composition of unknown substances. This experiment involves identifying the cations and anions in various salt solutions.



## What to record

Sample	Test performed	Result of test

## What to do

1. Dissolve the unknown substance in deionised water. 5–10 cm<sup>3</sup> of solution may be needed.
2. Using the analysis table, test small aliquots (portions).
3. Repeat for the other unknown substances.

## Safety

Wear eye protection. Some of the unknowns may be toxic or corrosive.



## Questions

1. Write word and ionic equations for those reactions that give a positive result.

### Testing salts for anions and cations.

For anions: carry out the three tests A,B and C below:

Test	Anion	Test and observation
<b>A</b> <b>Silver nitrate followed by ammonia solution</b>	Chloride (Cl <sup>-</sup> )	Add a few drops of dilute nitric acid ( <b>Irritant</b> ) followed by a few drops of silver nitrate solution. A white precipitate of silver chloride is formed. The precipitate is soluble in ammonia solution ( <b>causes eye damage</b> ).
	Bromide (Br <sup>-</sup> )	Add a few drops of dilute nitric acid ( <b>Irritant</b> ) followed by a few drops of silver nitrate solution. A pale yellow precipitate of silver bromide is formed. The precipitate is slightly soluble in ammonia solution. ( <b>causes eye damage</b> )
	Iodide (I <sup>-</sup> )	Add a few drops of dilute nitric acid ( <b>irritant</b> ) followed by a few drops of silver nitrate solution. A yellow precipitate of silver iodide is formed. It is insoluble in ammonia solution. ( <b>causes eye damage</b> )
<b>B</b> <b>Barium chloride</b>	Sulfate (SO <sub>4</sub> <sup>2-</sup> )	Add a few drops of barium chloride solution ( <b>Harmful if swallowed</b> ) followed by a few drops of dilute hydrochloric acid. A white precipitate of barium sulfate is formed.
<b>C</b> <b>Hydrochloric acid</b>	Carbonate (CO <sub>3</sub> <sup>2-</sup> )	Add dilute hydrochloric acid to the solution (or add it to the solid). Bubbles of carbon dioxide are given off.

For cations: carry out the two tests D and E below:

Cation	D Add sodium hydroxide solution ( <b>Irritant</b> )	E Add ammonia solution ( <b>causes eye damage</b> )
Ammonium (NH <sub>4</sub> <sup>+</sup> (aq))	Warm carefully. Do not allow to spit. Ammonia (alkali gas) is given off	_____
Copper (Cu <sup>2+</sup> (aq))	Blue (jelly-like) precipitate of	Blue jelly like precipitate dissolves in excess ammonia to



	$\text{Cu}(\text{OH})_2(\text{s})$	form a deep blue solution.
Iron(II) ( $\text{Fe}^{2+}(\text{aq})$ )	Green gelatinous precipitate of $\text{Fe}(\text{OH})_2(\text{s})$	Green gelatinous precipitate
Iron(III), ( $\text{Fe}^{3+}(\text{aq})$ )	Rust-brown gelatinous precipitate of $\text{Fe}(\text{OH})_3(\text{s})$	Rust brown gelatinous precipitate
Lead(II), ( $\text{Pb}^{2+}(\text{aq})$ )	White precipitate $\text{Pb}(\text{OH})_2(\text{s})$ dissolves in excess $\text{NaOH}(\text{aq})$	White precipitate, $\text{Pb}(\text{OH})_2$
Zinc ( $\text{Zn}^{2+}(\text{aq})$ )	White precipitate, $\text{Zn}(\text{OH})_2(\text{s})$	White precipitate, $\text{Zn}(\text{OH})_2(\text{s})$ dissolves in excess $\text{NH}_3(\text{aq})$
Aluminium ( $\text{Al}^{3+}(\text{aq})$ )	Colourless precipitate, $\text{Al}(\text{OH})_3(\text{s})$	Colourless precipitate, $\text{Al}(\text{OH})_3(\text{s})$

## Flame tests.

1. Slightly open the air hole of the Bunsen burner.
2. Heat a piece of nichrome wire in a Bunsen flame until the flame is no longer coloured.
3. Dip the loop at the end of the wire into some water.
4. Dip the loop into an unknown salt.
5. Hold the wire in the edge of the flame.
6. Record the colour and identify the cation using the table below.

Metal	Colour of flame
Barium	Apple-green
Calcium	Brick-red
Copper	Green with blue streaks
Lithium	Crimson
Potassium	Lilac
Sodium	Yellow

## Credits

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*Health & safety checked January 2018*

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